February 14, 2005

California Energy Commission
Dockets Office
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1516 Ninth Street, MS-4
Sacramento, CA 95814-5512

On Thursday, February 3, 2005, the California Energy Commission (CEC) held a Committee Workshop on Transmission – Renewable Integration Issues, Docket 04-IEP-01F. Prior to the stakeholder workshop the Consortium for Electric Reliability Technology Solutions (CERTS) had provided the CEC staff with background material related to an "Assessment of Reliability and Operational Issues for Integration of Renewable Generation." The background material was posted on the CEC web site on January 31, 2005. In addition, CERTS team made a presentation at the workshop on the same subject and hard copies of the presentation were available to all stakeholders in attendance.

CERTS "Assessment of Reliability and Operational Issues for Integration of Renewable Generation" is a work in progress, with a final report due in June 2005. The purpose of the scheduled workshop was to present the research findings to date in an open forum with all stakeholders.

The planned outcomes from the workshop were:

- Validate list of issues identified for the project.
- Identify if there are any gaps in the list of issues.
- Obtain stakeholder feedback on description of issues and any suggested modifications.
- Determine if the project is headed in the right direction and is adequately focused.

The CERTS team objective is to present a factual review of industry experiences and concerns, and identify the reliability and operational issues that would have to be dealt with as California integrates renewable generation to meet the Renewables Portfolio Standard (RPS).

During the Workshop on Feb. 3, during the roundtable following the presentation, the factual basis for two aspects of the materials developed by CERTS, namely E.ON Netz experience and Voltage, were challenged as being misrepresentations. The purpose of this note is to provide specific references and documentation for the sources relied on by the team in developing the materials for the workshop.

Issue 1. The description of aspects of the E.ON Netz experience
Figure #1 is a copy of the slide the CERTS representative presented at the stakeholder workshop that pertained to recent European experience integrating wind into system operations, including that of E.ON Netz:

E.ON Netz and Eltra Operating Issues for Integration of Wind

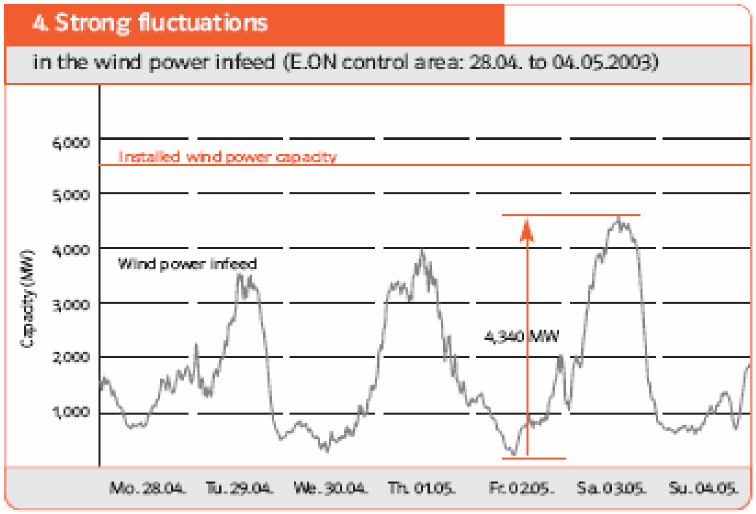
- Forecast Variability
  - Near-term forecast errors of 50 to 60%
- Production Variability (E.ON Netz)
  - Contribution to daily peak load ranged from 0.1 to 32%
- Ramping (E.ON Netz)
  - 6-hour production variability of 60 to 70% of installed capacity
  - Daily production variability of 4,300 MW
- Shadow Reserves – carry reserves for up to 80% of installed wind generation
- No grid voltage support during faults
- Wind plants disconnect during grid faults – E.ON Netz experienced 60% of wind generation loss due to voltage dip in one region
- Methodologies to address issues – generation management, grid code, high reserves, interconnection support

Electric Power Group CERTS 2/3/04 Page 9

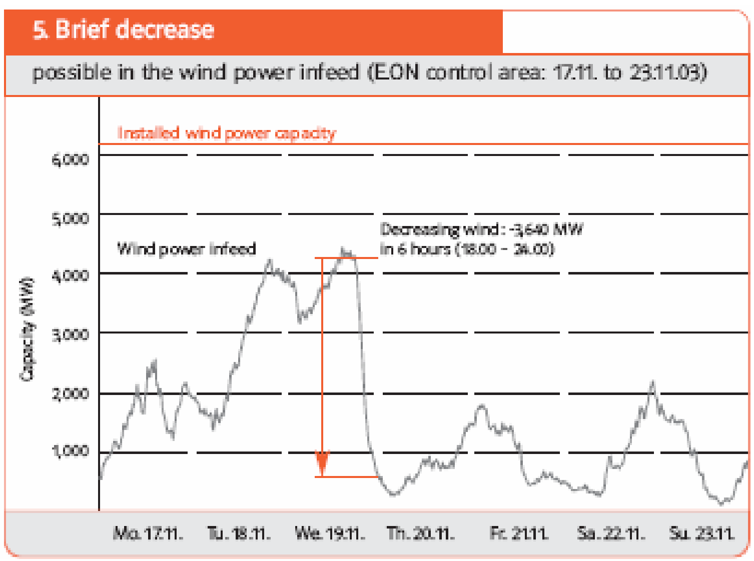
Figure # 1 – CERTS Presentation Slide #9

These conclusions were reached from the E.ON Netz report entitled, "Wind Report 2004" (http://www.eon-netz.com/frameset_reloader_homepage.phtml?top=Ressources/frame_head_eng.jsp&bottom=frameset_english/energy_eng/ene_windenergy_eng/ene_windenergy_eng.jsp). Specifically the following material excerpted directly from the report formed the basis of the slide:

Page 6 – "FIGURE 4 shows an example of the wind power infeed pattern in the E.ON territory during a week with strong winds. The difference between minimum and maximum infeed in this example was over 4,300 MW – equivalent to the capacity of six to eight large coal-fired power station blocks."



Page 6 – "The wind power infeed changes can occur in a relatively short time. This can be seen in FIGURE 5, which shows the wind power infeed pattern in the E.ON control area in the week of 17th to 23rd November 2003. It is clear that on 19th November, the wind power infeed dropped very sharply – by 3,640 MW within six hours, with an average value of 10 MW per minute."

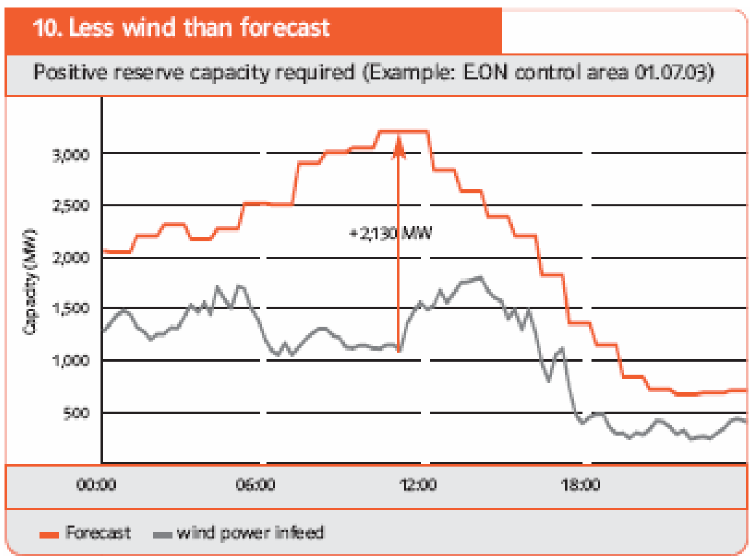


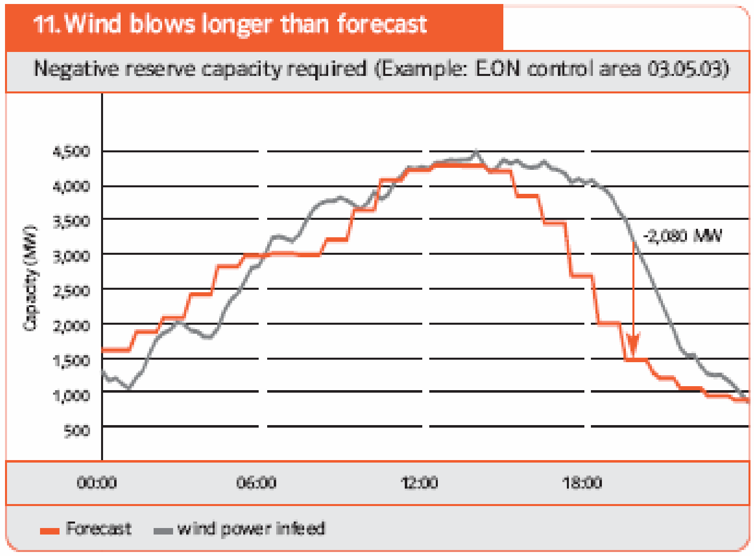
Page 7 "In order to also guarantee reliable electricity supplies when wind power plants produce little or no electricity – for example during periods of calm or storm-related shutdowns – traditional power station capacities must be available as a reserve. The characteristics of wind make it necessary for these "<u>shadow power stations</u>" to be available to an extent sufficient to <u>cover over 80% of the installed wind energy capacity</u>."

Page 9 – "Operational experience over the past few years has shown that <u>reserve capacities in the order of magnitude of up to 60% of the installed wind power capacity</u> must be kept for wind balancing in years when wind levels are normal. The need for reserve capacity and the resulting costs will therefore continue to rise in future parallel to the further expansion of wind power."

Page 9 – "In 2003, wind levels and therefore also the absolute fluctuation range of the wind power infeed were at above-average high levels. This meant that in retrospect, only reserve capacity amounting to around 50% of the installed wind power capacity actually had to be used."

Page 9 – "Of crucial importance to the wind-related demand for reserve capacity is the expected maximum forecast deviation and not, for example, the mean forecast error. This is because even if the actual infeed deviates from the forecast level only on a few days in the year, the transmission system operator must also be prepared for this eventuality and have sufficient capacity available so that a reliable supply is still guaranteed. FIGURES 10 and 11 (see below) show examples of the deviation between the actual wind power infeed and the forecast."





Page 10 – "In 2003, the expense required for balancing out the wind power fluctuations differed greatly in the four German control areas, depending on the wind power capacities installed there. Approximately half of the wind balance was done by E.ON Netz GmbH, even though its share of the ultimate consumer sales in Germany was only 30%."

Page 14 – "The operational behavior of wind power plants has so far differed greatly from that of traditional large power stations. Due to the massive and ongoing new expansion of wind power, it has therefore become increasingly difficult to guarantee the stability of the electricity supply – particularly in the event of a power failure. This means that wind power plants do not contribute to the same extent towards stabilising the grid frequency and to voltage stabilising as is the case with traditional power stations, which are actively involved in grid control.

But even more serious is the fact that wind power plants of the usual type have so far disconnected themselves from the grid even in the event of minor, brief voltage dips, whereas large thermal power stations are disconnected only following serious grid failures.

Faults in the extra-high voltage grid can therefore result in all wind power plants in the affected region failing suddenly. This means that within a very short time, the wind power supply of up to 3,000 MW can fail, thereby putting the grid stability at risk."

Figure #2 is a copy of the slide the CERTS representative presented at the stakeholder workshop that pertained to voltage issues:

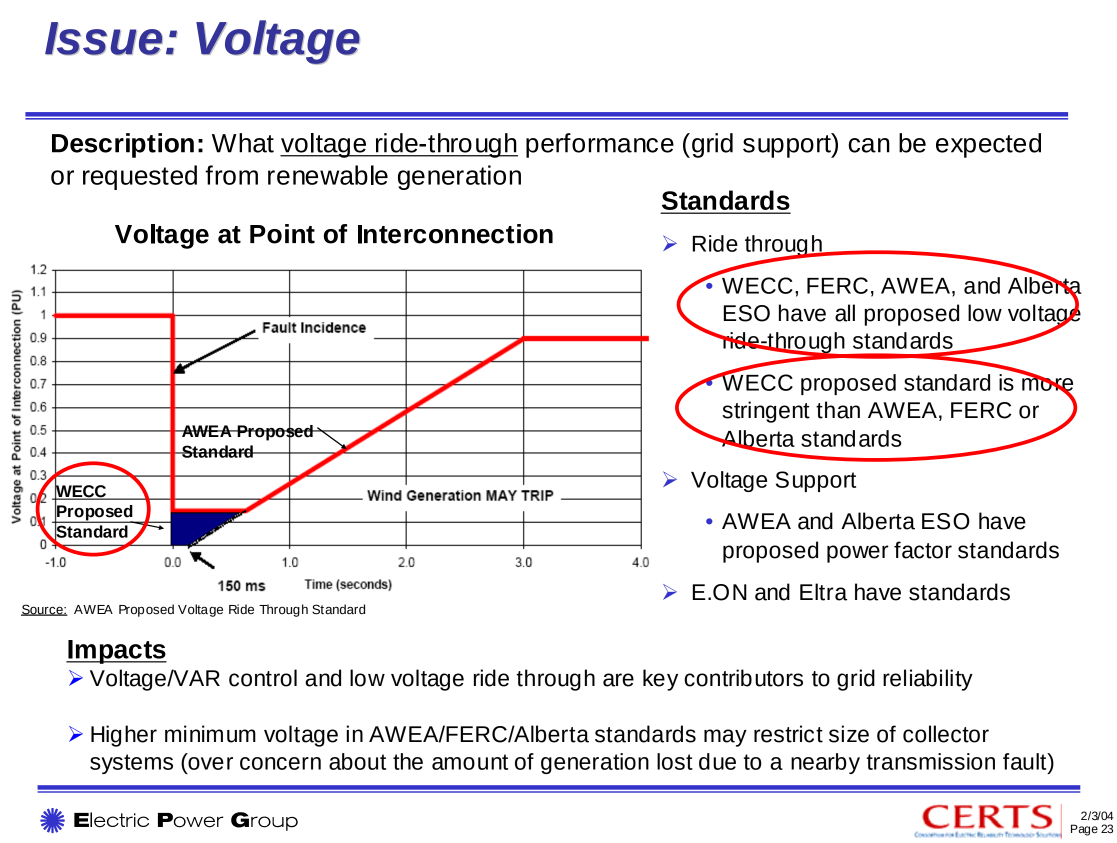


Figure # 2 – CERTS Presentation Slide #23

- As can be seen, the WECC proposed standard was presented as "proposed" as can be seen from the red circles in Figure #2, which is the CERTS presentation (slide #23). It was not presented as the "standard" as was suggested in the roundtable. The WECC proposed standard is the version dated Oct 21, 2004.

- The CERTS team used Figure #1 from AWEA's May 20, 2004, FERC filing (Standardizing Generator Interconnection Docket No. RM02-1-001, Petition for Rulemaking or, in the Alternative, Request for Clarification of Order 2003-A and a Request for Technical Conference of the American Wind Energy Association - http://www.awea.org/policy/gridcode.html), which indicates they should be able to ride-through a voltage decay down to 0.15 pu, at the point of interconnection.

- CERTS team juxtaposed the AWEA and WECC proposed standard to illustrate the system and reliability consequences of alternatives.

- The October 21, 2004 version of the WECC proposed standard (Sections 1 and 2) state:

  1. Generator is to remain in-service during system faults (three phase faults with normal clearing and single line to ground faults with delayed clearing) unless clearing the fault effectively disconnects the generator from the system.

2. During the transient period, generator is required to remain in-service for the low voltage and frequency excursions specified in WECC Table W-1 as applied to load bus constraint. <u>These performance criteria are applied to the generator interconnection point, not the generator terminals.</u>

Note: See the following WECC web page for a copy of the document: (http://www.wecc.biz/index.php?module=pnForum&func=viewtopic&topic=34)

The CERTS team's interpretation of the above sections is that the generator would have to ride-through a short duration close in fault down to zero (0) voltage. On this basis, the team concluded the WECC proposed standard was more stringent, since if the AWEA curve was adopted, then a wind generation plant would drop off following a short duration close in fault that resulted in a voltage decay below 0.15 pu. A consequence, if a less-stringent standard (defined in this manner) is adopted, is that it may impact the ultimate size of the collector station for this generation. That is, the potential impact would be based on the control area's ability to withstand the loss of a large quantity of generation for a single transmission contingency.

Note: At the time the workshop background material and the CERTS PowerPoint presentation were completed and sent to the CEC staff, the WECC's October 21, 2004, version was the only proposed LVRT standard posted on their site. We subsequently learnt that a revised version of the standard was proposed and posted on their web site on February 2, 2005, the day before the workshop. As of this date, no final standard has been adopted by WECC and what may finally get adopted may be the result of additional changes and revisions.

<u>Action Items Going Forward:</u>

The CERTS team will continue its research and fact finding in all aspects and issues related to this project and will provide the stakeholders with the latest information and facts available at the next scheduled workshop in late April.